Physics 151 Final Exam

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NAME

1. A car is traveling at 100 km./hour. It decelerates at a constant 1.9 m/sec$^2$ until it stops. How far does it travel before stopping?

2. A force of 250 nt is directed 30° below the negative x axis (3rd quadrant) and another force of 220 nt. acts on the same body at an angle of 47° below the positive x axis (4th quadrant). If the mass of the body is 35 kg. And gravity acts directly along the negative y axis, find the magnitude and direction of the resultant acceleration.

3. A projectile is fired at an angle of 47° above the horizontal with an initial speed of 95 m/sec.. It hits on top of a cliff 45 meters above its initial elevation. What is it's final speed.
4. A block slides down an incline of $47^\circ$ (from the horizontal) a total distance of 12 meters. If the coefficient of friction between the block and the plane is .27 how long does it take to make the trip?

5. Using conservation of energy find the speed of the block in problem 4 when it has finished the slide of twelve meters.

6. A bullet moving horizontally smashes into a block of wood which is attached to a horizontal spring. If the spring has a spring constant of 250 nt/meter, the block of wood has a 1.0 kg mass, the bullet a 100 gram mass, and the spring is compressed 10 cm., and there is friction with a coefficient of .45, how fast was the bullet traveling before the collision? (The bullet stays in the block after the collision.)
7. A pulley, made of a solid cylinder (3 kg mass and 25 cm radius) A 3 meter long rope is wrapped around the pulley, and is attached to a 1.5 kg mass. As the mass falls, the rope unwinds causing the pulley to spin. What will the speed be after the mass falls the 3 meters?

8. A torque of 2.6 nt-m is applied to a hollow ring of mass 5 kg. which is spinning at 120 rev/min. If the radius of the ring is 1 meter., through how many complete revolutions will it turn before stopping?

9. In a roller coaster the car is to make a circular loop in a vertical circle 50 meters diameter. What is the minimum speed at the bottom it must have to complete the loop without mechanical restraints to keep it from falling off the track at the top?
10. A sign is supported by a hinge attachment on a wall, and a wire attached to the mid point of the sign at a 40 degree angle running back to the wall. The sign weighs 500 newtons, and is its length is $L$. Find the tension in the wire.

11. What is the pressure at the bottom of a 10 meter deep tank filled with water (total pressure)?

12. A rock with density 3600 kg/m$^3$ is weighed in air and found to weigh 55 nt. It is then weighed in a fluid which has an unknown density and found to weigh 30 nt. What is the density of the fluid?
13. As an airplane takes off, the speed of the air on the upper surface of its wings is 100 m/sec and across the bottom surface only 75 m/sec. If the wings have 90 m$^2$ surface area, what is the lift force on the plane?

14. What is the length of an organ pipe open at one end which has a fundamental note of 120 Hz if the speed of sound in the gas inside is 900 m/sec.?

15. A policeman chasing a speeder is blaring his siren at a frequency of 1200 Hz. The policeman is moving at 120 km/hour, and the speeder "hears" a pitch of 1250 Hz. What is the speed of the speeder?